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ABSTRACT

This report presents a proposal and plan for the use of contemporary technology at North Iowa Area Community College (NIACC). Part I provides an overview of the use of contemporary technology in business, industry, and postsecondary education; highlights NIACC's contemporary technology strategic planning initiative; and outlines NIACC's proposal and plan for contemporary technology. Part II discusses the updating of manufacturing technology, offering an analysis of the impact of technology on manufacturing and implications for NIACC; and presenting the college's proposals and plans for manufacturing technology. Part III highlights the process of updating business technology, including a discussion of the impact of technology on business and the implications for the college; a proposal and plans for business technology; an overview of the status of office technology at NIACC and a proposal for 1984-85; an examination of the status of microcomputer technology and a proposal for 1984-85; and future plans in office and microcomputer technology. Chapter IV discusses the expansion of technology in the humanities, including an analysis of the impact of technology on humanities instruction and the implications for NIACC; a proposal and plan for using technology in the humanities; and future plans for using technology in the humanities. Finally, chapter V provides a summary and recommendations. (HB)

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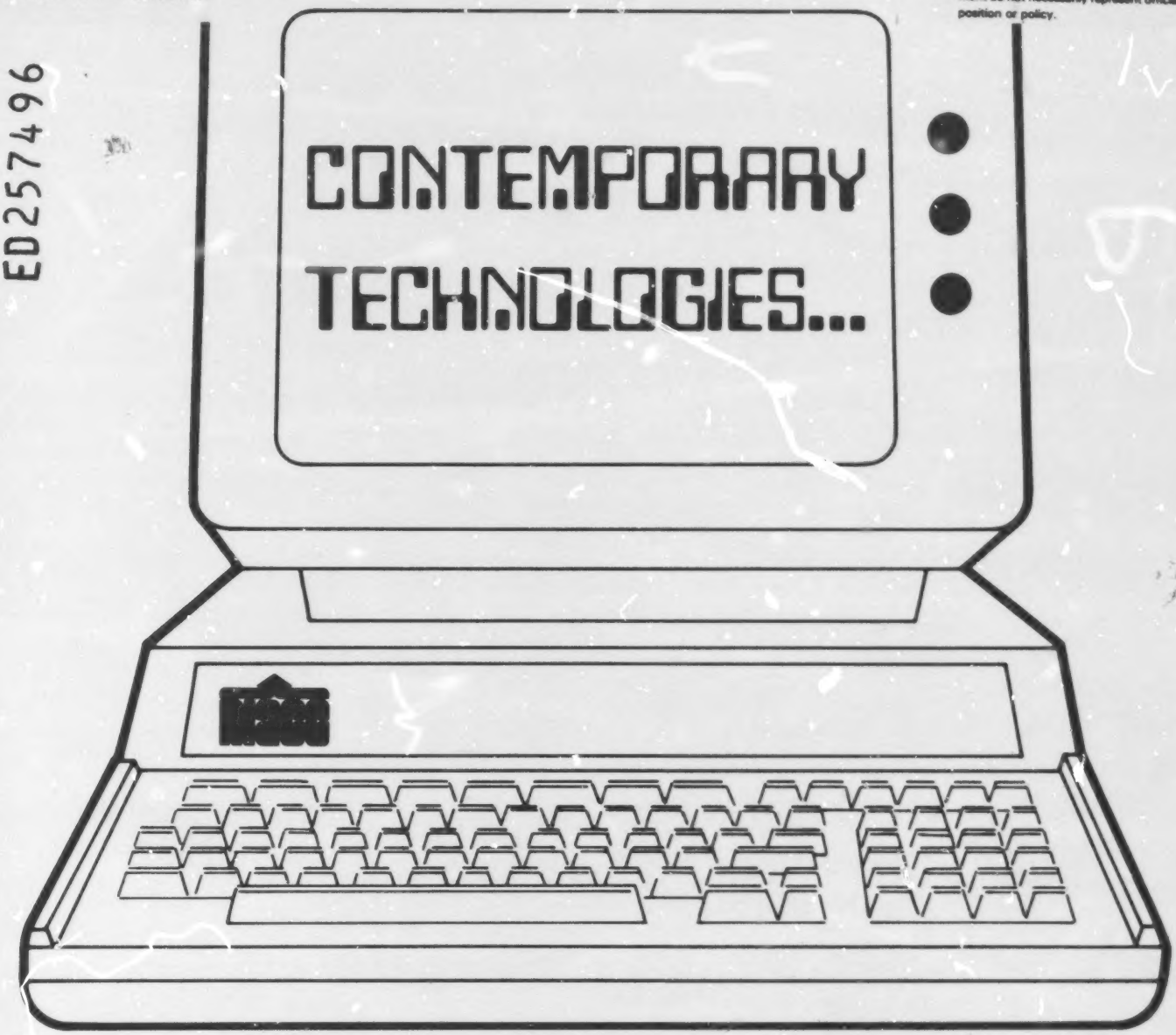

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... A Plan for NIACC'S Future

NORTH IOWA AREA COMMUNITY COLLEGE

A PROPOSAL AND PLAN
for
CONTEMPORARY TECHNOLOGY AT NIACC

Presented to

Dr. David Buettner, Superintendent
and
the NIACC Board of Directors

by

The Contemporary Technology Task Force

April 16, 1985

"COLLEGES HAVE A NEW OBLIGATION TO PREPARE STUDENTS FOR LIFE IN A SOCIETY SATURATED WITH TECHNOLOGY AND TECHNOLOGICAL ISSUES."

JAMES D. KOERNER, PRESIDENT
ALFRED D. SLOAN FOUNDATION

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Part I

PLANNING FOR CONTEMPORARY TECHNOLOGY AT NIACC

An Overview of Use of Contemporary Technology in Business, Industry, and Postsecondary Education

Business and Industry. At General Electric's newly automated locomotive plant in Erie, Pennsylvania, a robot selects and inserts cutting tools into milling machines. A robot-like vehicle delivers huge locomotive motor frames to nine large "smart" machines that, under computer control, perform numerous machine operations in sequence. Before automation, 20 workers took 16 days to complete all of the milling processes on a single motor frame; with automation, two computer technicians and four semi-skilled workers finish a motor frame in only 16 hours. General Electric's $500 million investment in this locomotive plant has enabled it to remain competitive in the marketplace. According to a General Electric executive, "Without our...investment program, we could not remain competetive, and we all know where that would lead. The factory of the future is the only factory that has a future."[1]

A recent interview survey of Michigan businesses and industries found that three of every four durable manufacturers use computer-aided design technology. Half of the durable and two-thirds of the non-durable manufacturers are using computer-assisted manufacturing automation. Office automation and telecommunications technology are commonplace in the business office. Two-thirds of non-durable manufacturers and retail trade firms have sophisticated materials management systems.[2]

Visits to businesses and industries in metropolitan Chicago reveal similar applications of computer-based technology. At the General Telephone and Electronics Company, for example, sophisticated computer-controlled assembly lines automatically solder and test complex electronic circuit boards and telephone system switching devices. Keebler Baking Company and Sears and Roebuck operate automated warehouses in which computer-controlled robots handle receiving, inventory control, materials storage and retrieval, shipping and bottling operations with the help of a minimum of human workers. Office automation is commonplace in all kinds of business offices including financial institutions, insurance companies, hospitals, manufacturing firms, law offices, and government agencies.

Postsecondary education. Postsecondary education uses contemporary technology as extensively as do businesses and industries. Since the invention of the computer and the pioneering of computer-assisted instruction in the 1950s, universities have been significant contributors to the research and development of computers, computer-related technologies, and their applications. In addition, along with community colleges, universities teach students to use computer technologies in career preparation programs for a variety of fields. For example, Iowa State University's Engineering Technology Assistance Program includes training in computer-aided design and drafting systems and offers computer access and consultation to industry.[3] In fall, 1985, Rochester Community College will launch an associate degree program to prepare automated manufacturing technicians.

Business applications of computer technology are commonplace in postsecondary education. At Storm Lake, for example, Buena Vista's new business building has a modern microcomputer laboratory in which students learn how to use the computer as a tool for business decision making. The University of Northern Iowa has a similar microcomputer laboratory for business programs. Most Iowa community colleges and many Area II high schools include word processing opportunities in their curricula.

Postsecondary education uses many forms of Computer-Assisted Instruction (CAI). For almost 30 years, the University of Illinois, in cooperation with Control Data Corporation, has been developing, testing, and marketing Programmed Logic for Automatic Teaching (PLATO)--the most extensive computer-assisted instruction system in the world. Numerous computer-assisted testing systems have been developed to help instructors construct, score, and interpret tests. More recently, computer-assisted writing programs have been developed. Colorado State University, St. Olaf, and NIACC are pioneers in the use of Writer's Workbench in postsecondary education.

As the preceding examples illustrate, contemporary, computer-based technology is used extensively in business, industry, and postsecondary education. In fact, technology is changing how America conducts business and is changing how and what college students learn.

NIACC's Contemporary Technology Strategic Planning Initiative

NIACC's 1982-83 institutional self-study for extension of regional accreditation identified "contemporary technologies" as one of five key areas requiring institutional initiative. College examination of this initiative determined that:

-- Technological advances demand workers with high levels of abstract reasoning and specialized knowledge. Highly trained technicians will be needed to maintain contemporary technology equipment and procedures.

-- Young people and adults are seeking education which will enable them to cope effectively with the demands of a technological society.

-- A responsible college should strive to prepare students for life in a technological society.

-- A college must be heavily involved in new and emerging technologies to properly facilitate student learning in this area.

-- Realistically, a college cannot hope to be at the state of the art in all or most technologies. However, any college that expects to play a role in postsecondary education in the future must strive to be among the early adopters of new technology to accomplish their mission.[4]

Based upon these considerations, NIACC's recently drafted Three- to Five-Year Plan includes the following major objective:

> *Eliminate all significant deficiencies between college educational resources and practices and commonly found equipment, procedures, or concepts in comparable educational or industrial settings.*

One of the activities selected to contribute to this major objective is to "provide for regular investment in the technological currency of the college."4 To address this activity in 1984-85, the College has continued to encourage and support formal and informal staff investigation and interest in emerging technologies in the fields of manufacturing technology, business, and humanities. Over the course of the year, staff members in these disciplines have expended substantial time and effort learning about trends, computer-based hardware and software, and educational applications of these technologies.

Recently, the explorations of these groups have been formalized into the Contemporary Technology Task Force which has prepared this proposal and plan to specify our intended direction in this area and to seek support for this important initiative. An overview of the proposal and plan is given in the next section.

An Overview of NIACC's Proposal and Plan for Contemporary Technology

As indicated in the previous section, contemporary technology has been explored by faculty in the areas of manufacturing technology, business, and humanities. The next three sections of this proposal present the results of the investigations of each of these groups in the order named above. The common topics presented in these sections include further examples of the impact of technology on that discipline to supplement those examples given in the initial overview. In addition, these sections include a proposal and plan for updating and expanding our ability to deliver state of the art instruction in that discipline.

Each proposal and plan starts with a description of our present status in that area, presents a 1984-85 proposal for updating that technology, and provides a description of future plans for updating and expanding technology in that area. The proposal portion of each section describes the criteria used to select the computer-related equipment requested, a description of that equipment, an estimate of costs involved, the curricular applications of the equipment, an indication of the credit and non-credit students to be served with the equipment, and the intended location and arrangement of the equipment. The proposal and plan concludes with a summary and a recommendation that the Board of Directors authorize expenditure of sufficient funds to enable the College staff to implement the next steps in this initiative.

Part II

UPDATING MANUFACTURING TECHNOLOGY

The Impact of Technology on Manufacturing and Implications for NIACC

Dateline Washington, D.C., White House Computer Conference on Productivity: William H. Slautterback, Director of Manufacturing Systems, of Koppers Company, Inc., forecasts "Manufacturing will change more in the next 15 years than it has in the last 75 years. Firms will adapt or perish."

That dramatic prediction pales in the light of one by John R. Holland, manager of the Allen-Bradley Factory Automation Laboratory. At a recent CAM-1 Conference, Holland declared, "On a global scale and by historical standard, we now find ourselves in the midst of a technological revolution on the order of the discovery of fire, the development of the water wheel, the printing press, and nuclear power. This revolution will for all time change our way of life like no other change before it...This revolution is the information revolution based on electronic miniaturization and fundamental logic."

That miniaturization and logic provide the base for computer-integrated manufacturing or CIM. The subsystems of CIM include computer-aided engineering (CAE), computer-aided testing (CAT), computer-aided process planning (CAPP), and computer-aided quality inspection, robots, numerically controlled machine tools (CNC/DNC), and the most widely used computer-aided design and computer-aided manufacturing systems (CAD/CAM).[1]

State of the art. General Motors is leading the way in developing and defining standards for linking equipment through these communication systems. GM projects that the current 20,000 programmable devices within manufacturing will escalate to 40,000 within two years.

Because design work is basic to all manufacturing processes, the computer-aided design software is basic to all systems. In fact, CAD has already replaced much of the mechanical drafting previously done on the board. Furthermore, even in 1983, 20 percent of the CAD systems were actually the more sophisticated CAD/CAM systems that hold the greatest potential for increasing productivity.

Aircraft manufacturers routinely pass data base information directly from the design phase to the manufacturing phase through the use of CAD/CAM.

Ford Motor Company sends design data, through telephone interfaces, directly to the suppliers who produce numerical control tapes for making such parts as engine mounts, ball joints, frame crossmembers, and styled wheels. Using CAD/CAM to eliminate the paperwork of drawings and the problems associated with that method, Ford saved six weeks in the development of a plastic injection-molded steering column shroud. Ford intends to eliminate all manual drafting within the next five years.[2]

In the March, 1985, issue of Design News, Dorfman reports that CAD/CAM usage is increasing by 30 to 40 percent each year and will continue to do so until 1990.[2]

Thomas Carlyle, the nineteenth century historian, wrote "Man is a tool-using animal; without tools he is nothing;..." CAD/CAM is the latest set of tools making work more productive for the engineering team. CAD/CAM is so powerful a tool that the National Science Foundation has said it is the greatest invention since electricity. Engineering reflects industry's efforts to become more productive through CAD/CAM.

At the present time, drafting and engineering work on the computer cover a wide range of practices from drawing lines and producing drawings to creating designs with wire-frame shapes and producing color and shaded models with the quality of a 35mm slide.[3]

North Iowa businesses and industries are substantial users of contemporary technologies. Winnebago Industries and John Deere are using computer-aided design (CAD); and computer-controlled mills, lathes, and punch presses are used by Iowa Mold and Tooling, Schneider Metal Manufacturing, United Hydraulics, and many other firms. Many manufacturers in Area II, including Fox River Mills and Wallace Business Forms are using computer systems for inventory control, shipping, billing, and related management applications. In spite of the job displacement which accompanies automation, the Iowa Office for Planning and Programming projected a 20 percent increase in Area II manufacturing employment from 1984 to 1995.[4]

Trends in design. The trend in design is toward even more sophistication. Complex geometrics, intricate details, and assembly locations are significant when combined with a data base that allows detailed engineering analysis. These analyses include not only the basic geometric properties of volume and center of gravity but also detailed stress analysis and CAM functions centered on numerically controlled (NC) programming. All of this capability results in increased accuracy, speed, standards, and verification of tool-paths before the raw material even reaches the machine.[5]

Challenges for colleges. Of course, with these technological changes come employer demands for job applicants literate and skilled in computers and in computer applications such as CAD/CAM. Even those currently employed as draftspersons must upgrade their skills if they wish to retain their positions.

Where will those seeking jobs look for training, and where will those requiring retraining turn for that training? They will find that training in the educational systems -- traditionally the community colleges. But necessarily, they will purchase that education only from colleges that offer the sophistication of the high technology equipment and studies that employers demand. Those colleges will attract and will draw students from the lesser equipped institutions.[6]

Even now, every community college in Iowa has two-dimensional CAD. But in industry, two-dimensional CAD is already part of the past; those employers now look to applicants from colleges with CAD/CAM training. High school counselors and industrial-related students look to those same colleges. If NIACC hopes to enroll those students, NIACC must meet the challenges set by industrial employers.

Our Proposal and Plans for Manufacturing Technology

Present status. Currently, while most of our drafting instruction takes place on drawing boards, a two-dimensional CAD system is shared by our Mechanical Design, Pre-engineering, and Electronics programs. This first step in the use of contemporary technology has enabled faculty to develop some basic computer-aided drafting skills as a supplement to traditional drawing board skills.

However, the ratio of computers to students limits Mechanical Design students to computer-aided drafting for only 10 to 12 percent of their drafting time and confines Electronics students to computer-aided drafting for only one to two percent of their drafting experience. Equally as important as the limitations on computer time are the limitations imposed by the use of a two-dimensional system with students whose potential employers seek applicants with the more complex three-dimensional systems.

To keep pace with other postsecondary schools, to meet the needs of local and state industries, and to provide the skills our Mechanical Design and Electronic Technology students must have to find employment, we need to add a three-dimensional CAD system as the next of several updating steps.

NIACC's Pre-Engineering program enrolls approximately 35 students each fall. Most of these students transfer to Iowa State University (ISU) while a few go to the State University of Iowa (SUI) or to out-of-state institutions. To ensure our graduates' success in those schools, we set our engineering curricula according to the universities' requirements. All pre-engineers must have Engineering Graphics, which includes drafting and design. As are most engineering schools, ISU and SUI are heavily committed to using computers in their graphics programs.

Currently, we use the Milwaukee Area Technical College CAD program on six stations for two drafting problems in the second semester of Engineering Graphics, and we use a design problem prepared by ISU on a DEC graphics terminal connected to the VAX mainframe. As we expand the use of computer-aided drafting and design (CADD), the six MATCCAD stations and one VAX station become more and more taxed. In addition, the present system will not allow us to provide many of the computer applications that we should, such as three-dimensional drawing. In Statics of Engineering, we also need the use of the design portion of CAD/CAM for solving problems.

We need CAD/CAM to enable us to expand the content of our program and to provide students with the computer time required for them to learn the content that they must have when they transfer to the four-year programs.

NIACC's Pre-Engineering students have traditionally done very well when they transfer to the engineering schools. To ensure their continued success, we must include CAD/CAM and adequate computer time in our engineering courses.

Proposal for 1984-85

Equipment selection. Following several of the recommendations of Chasen and Dow, the manufacturing technology faculty attended CAD conferences and seminars, collected product descriptions from numerous vendors, reviewed periodical and journal articles, talked with several users (including members of the NIACC Mechanical Design Advisory Committee), and developed a list of characteristics on which to compare various CAD systems.[7]

There are dozens of companies with CAD/CAM systems. Many were eliminated fairly early because they did not have features we wanted or were too expensive (considerably more than $100,000) for from three to six stations or have gone out of business. We have listed data on five systems in Table 1 on page 8.

The first listed is an IBM system capable of doing what we want; however, the price is about two and one-half times what we feel we can justify. It was included in the chart for comparison because IBM is a giant in the computer industry and has a growing reputation in CAD/CAM. Maintenance is also high. Less costly IBM systems would not do what we need.

The second listed is a combination: a DEC VAX CPU, Tektronics terminals, and a software package called Anvil 4000. This system would have some advantages. VAX CPUs and Tektronics terminals are popular. ATECC, ISU, SUI, UNI, Drake, and much of industry use VAXs. ISU, SUI, and much of industry use Tektronics terminals. Anvil 4000 in its earlier version is one of the first CAD/CAM packages around and evolved into its present form over the years. However, the VAX 730's capability to support only three stations would make expansion costly. A used VAX 750 is $85,000, and the Anvil 4000 is $40,000 on a 750. Even without any terminals, the price is already considerably more than $100,000.

The third system uses DEC hardware that would be connected to ATECC's VAX with Design Graphics software. Although advertised as a 3-D system, it will only handle wire-frame solids of revolution. Very limited 3-D and no numerical control are its biggest shortcomings.

The fourth system is priced nicely and does many things well but, among other things, lacks numerical control and is slower than some with its 16-bit CPU.

The fifth system meets our requirements. The software already has many of the features other companies are only promising within the next year. Additional software available for this system includes several standard programming languages, a word processing package, and several business management packages. The industrial user and the six community college users we talked to across the country recommend PSI highly in terms of the user friendliness of the system, the extensive and inexpensive software updates, the reliability of the hardware, and the prompt hardware maintenance when needed. In addition, the PSI system can store student drawings on the ATECC VAX or on a student's floppy disk. The system price includes a high quality plotter and work station furniture (except chairs).

Consequently, we recommend purchasing a four-work station PSI system and accompanying chairs for approximately $118,000. The comparative analysis of these systems is given in the following table.

Table 1

A COMPARATIVE ANALYSIS OF CAD SYSTEMS

Characteristic	IBM 4361 CADAM	VAX TEKTRONIX ANVIL 4000	DEC PRO350 DESIGN GRAPHIX	POINT LINE CADD	PSI
Types of Projections					
2-D	Yes	Yes	Yes	Yes	Yes
3-D	Yes	Yes, but not solids	No	Yes	Yes
Color?	16 from 256	8 from 256	Yes - 3 from more than 3000 colors	Yes - One screen, toggle menu	8, 14" screen plus 12" screen
Resolution in pixels	1024 x 1024	640 x 480 13" screen	960 x 240	640 x 475	600 x 800
Applications					
Mechanical	Yes	Yes	Yes	Yes	Yes
Electronics	Yes	Yes	Yes	Yes	Yes
Architectural	Yes		Yes	Yes	Yes
Mapping	Yes	Yes	Yes	Yes (limited)	Yes
Piping	Yes		Yes	Yes	Yes
Other	Finite analysi		Business graphics	Graphic arts renderings	
Industry standards	Kinematics	ANSI 78, 82 Britain, Japan			
CAM					
NC/CMC	Yes	Yes	No	No	Yes
Paper Tape	Yes	Yes	No	No	Yes, or direct
Business applications	Bill of materials	3rd party software on VAX	3rd party software	Bill of materials	CPN +
	Investing, costing, etc.	File transfer	Bill of materials	3rd party software	File transfer
				Available - file transfer	Bill of materials
					Parts catalog
Computer Type					
Micro	32-bit CPU	32-bit CPU	16-bit CPU 512KB	16-bit CPU 2-8" floppy disks	32-bit CPU 50 MB Disk
Mini					
Main frame		VAX 750	800KB on 2, 5 1/4" Disk drive		
Multitasking?	Yes	Yes	Interfaces with VAX	No	Yes
User friendliness	On line HELPS	On line HELPS	On line HELPS + TEACH (CAI)	No HELPS needed	On line HELPS files (300 screens)
Installation					
Training					
Installation?		Included in price		Included in price	Included in price
Training?	9 days instruction for faculty out of state		40 hours @ $1000/ person in LA	2-18 hour courses @ $780/course	2 days at NIACC
Hotline?		Yes (800) + local	Yes (800) + local	Yes (800#)	Yes (800#) + modem on terminal
System Backup?		1 hour/week		No	Auto hard disk
System maintenance					
Hardware	$24000/yr-hardware	VAX $7192/year TEKTRONIX-1 yr warranty		$4,500/year-loaner equipment during repairs	On site within 2 days
Software	$74828/yr-software	$5000/yr (not solids)	$3000/yr	$1000/yr for updates (not CAM)	$2324/year for 4 1 yr updating included - $200/ year thereafter
Satisfied users		ISU, U of Ia, UNI, Drake			
CC			ISU	Kirkwood CC has one in budget	
Industry	Several local industries				Several community colleges across the country
Price range	Hardware $241,156 for 4 CADAM 18,882 $260,038 or $65,010/station	Used VAX 750 - $85,000 New TEKTRONIX 4202s $8108 Anvil 4000-$40000 or $49,775/ station for 3	$16,219/station for 8 + furniture + plotter	$17,568/station for 4 $17,815/station for 5 + furniture + plotter	$29,500/station for 4 with plotter and furniture

Source: Vendor demonstrations, proposals, and product descriptions

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Curricular Applications. A three-dimensional CAD system will permit the development of high level curricular applications in the Mechanical Design, Pre-Engineering, and Electronics programs.

To the present, CAD systems for Mechanical Design have been involved principally with product layout. This instruction has included parts and assembly definitions, detailing, drafting-type output, bills of materials, and other similar functions in the mechanical application areas. Where only drafting output is required, functions have been performed using two-dimensional systems. However, when a data base is required, then, a three-dimensional capability is required.

Solid modeling is one of the major new components of CAD. By using this system, true volumetric models of parts or assemblies can be captured in a data base. The methods of defining solids are based upon two approaches or their combination, namely, constructive solid geometry and boundary definition.[9]

Boundary definition is essential in order to prepare designed objects for computer-aided manufacturing. Object design taken from CAD must be enhanced with characteristics like toolpath, tool size, speed of travel, and depth of cut in order for the part to be made on a numeric control (NC) machine.

One of the most recent major directions that CAD/CAM has taken is in the development of CAE (computer-aided engineering) work stations. CAE work stations are intended principally for the front-end engineering functions, including conceptual design, simulation, modeling, and analysis, as opposed to part and product layout.

CAE may be defined as the process of creating a product or system model in graphic and data form. The model may simulate product performance through interactive viewing and computer analysis, thereby lessening the reliance on traditional prototype testing. CAE work stations provide design and development engineers with desktop or stand-alone models that have previously been unavailable. These tools provide capabilities not only for performing design analysis but, equally important, for initiating the data model. Such a model establishes the link for integrating the product design process with manufacturing, testing, and product quality.

The future of CAD/CAM may be clearly inferred as CAD and CAM functions are broadened to encompass CAE and, then, C.M. CAE will permit a high degree of concept-to-product modeling, finite element analysis, post analysis review and modification. These capabilities minimize dependence on prototype production and testing but probably will not eliminate the prototype phase completely.

Product design will be significantly facilitated by the prior CAE design, analysis, and manufacturability review process. The design-to-manufacturing cycle will be further reduced by having better and more complete design information and more complete and accurate information from hardware designers and retailers in the data base.[5]

Students to be served. As shown in Table 2, based upon current enrollment levels in manufacturing technology programs, we project that about 180 students per year will be served initially by a three-dimensional CAD system. This number will increase as we add curricula and publicize state-of-the-art instruction in this area.

Table 2

Students to be Served by a Three-Dimensional CAD System

	Current Enrollment	Projected Enrollment
A. Day Programs - Credit		
1. Mechanical Design	17	20
2. Pre-Engineering	35	40
3. Electronics	36	40
4. Manufacturing Technologies	17	20
	105	120
B. Evening Classes - Credit		
1. Evening Electronics	15	30
2. Evening Pre-Engineering*		10
3. Mechanical Design*		10
	15	50
C. Evening Non-Credit		
1. Industry - Short-term	30	50
2. Statistical Process Control	30	50
	60	100
TOTAL	180	270

*Possible additions

Location and layout. Figure 1 shows the perimeter location for the present and proposed CAD equipment in MH 218. Figure 2 shows the equipment layout. The rationale for this configuration follows:

(1) It is more efficient for instruction. The instructor need not leave the graphics area to assist the student or to demonstrate on the CAD.

(2) The outer walls have electrical outlets to supply the needed power for the equipment.

(3) It should provide a good area where the lighting can be controlled. Lighting should be on the dim side to make viewing of the screens easier. The selected area is away from any windows which could cause reflections on the screen, making it difficult to see work.

(4) Students should experience fewer distractions because they will be facing the wall while working on the equipment.

(5) The location should provide ease of supervision because the equipment is in direct viewing line from the staff's office.

(6) Utilization - Students from one class could use the CAD equipment while another class is in session using the drawing boards which occupy the rest of the room.

(7) Location is "eye catching" when one enters the classroom.

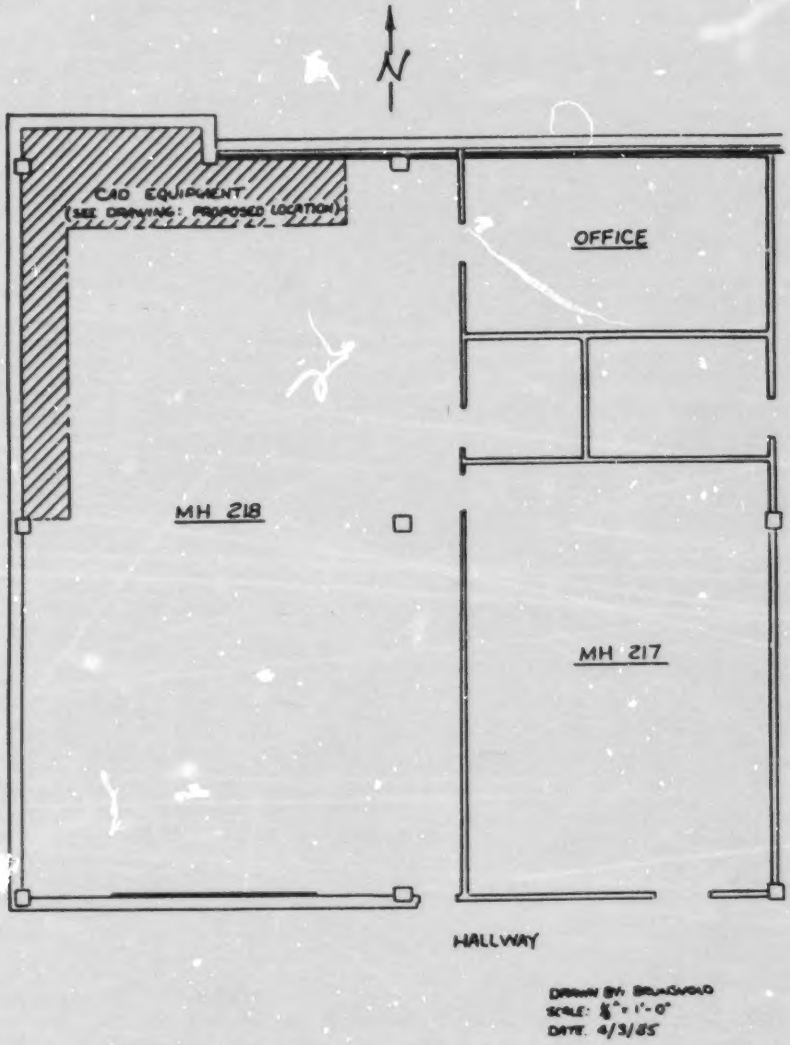

Figure 1

MH 218 Location of CAD Equipment

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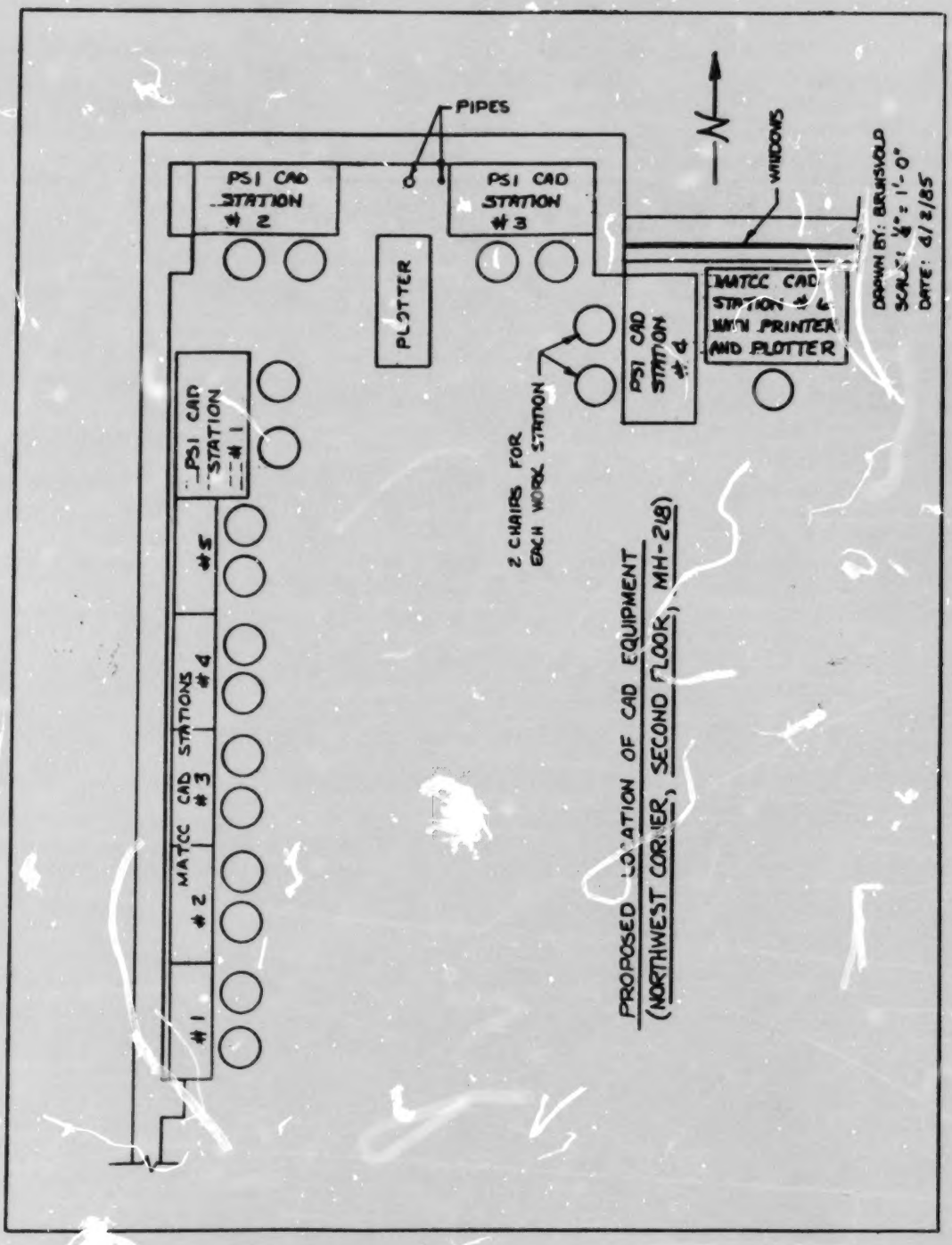

Figure 2

MH 218 Layout of CAD Equipment

Future Plans for Manufacturing Technology

The next logical step following the integration of CAD into Mechanical Design and other programs would be CAM (Computer Aided Manufacturing). This combination is becoming known as a manufacturing cell. The results of CAD can be used in two ways -- first as input in manufacturing resource planning and second as the input in CAM. As Figure 3 shows, CAM involves control of the actual machining process via numerical control (CNC); control of robotics (feeding the machine) and/or materials handling, and, last, automated inspection.

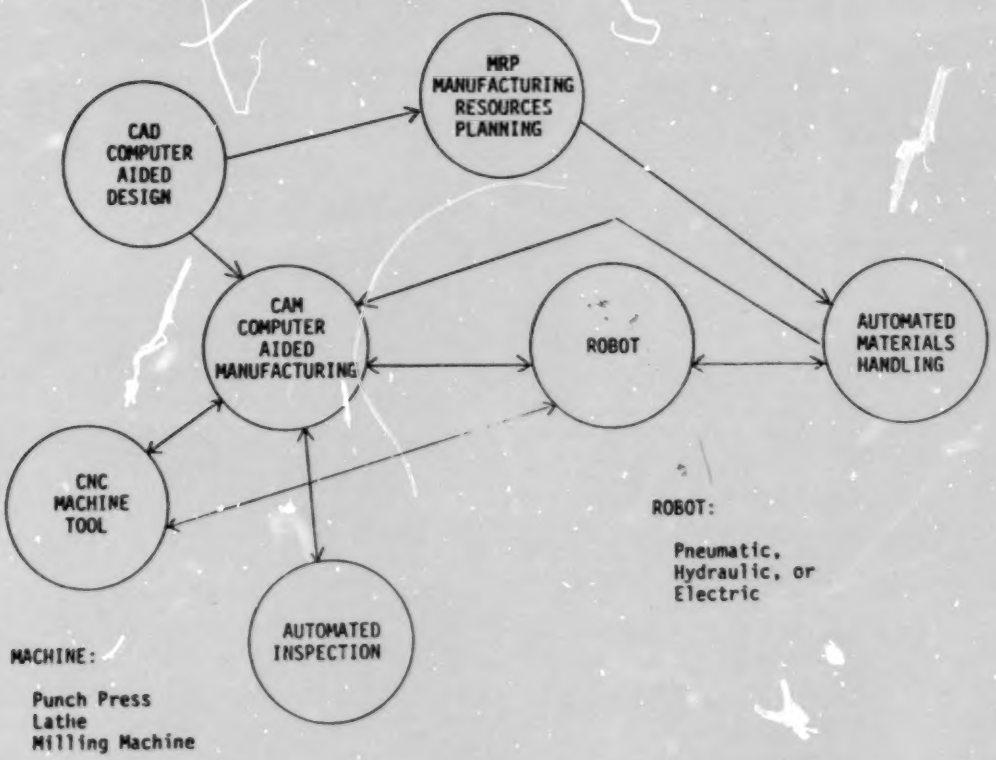

Figure 3

A CAM Manufacturing Cell

Following the integration of CAD/CAM into our manufacturing technology curricula, we shall move toward a Computer-Integrated-Manufacturing (CIM) system. Such a system expands the common data base used in CAD/CAM to integrate the development of technical publications, part definitions, and related business management functions (see Figure 4).[9]

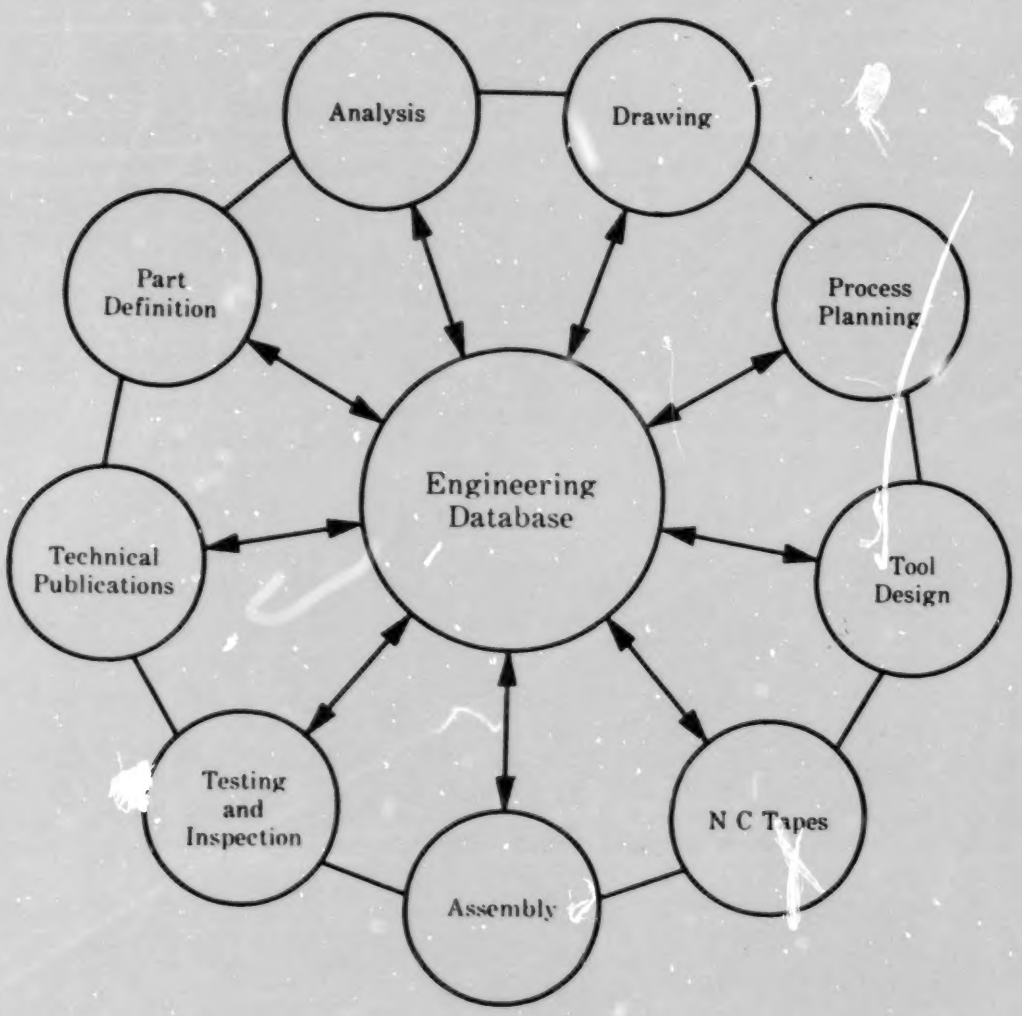

Figure 4

Computer-Integrated-Manufacturing

For educational purposes, a model manufacturing cell might be set up to simulate the actual manufacturing process by using model production hardware. A small NC lathe, milling machine or punch press, along with a small robotic device and other automated handling devices, could be assembled to conceptualize the total CAD/CAM process.

An alternative to the actual manufacturing process would be to concentrate more on the programming of robots and the use of sensors in such areas as safety, sorting, and quality control.

A third approach might be the use of breadboards to tie all the components of the manufacturing process together. In many cases, the mechanical breadboard system will provide true-to-scale operation of some manufacturing functions. The interfacing of educational robots with the breadboard is often useful as that robot automation can be tested and taught with the system.[8]

Updates in manufacturing technology at NIACC will accompany our vocational modernization initiative and will enable us to offer career programs which prepare students to work in contemporary manufacturing settings. In fact, contemporary technology will provide the foundation upon which we will restructure a significant portion of the programs in our Industry-Related Division.

For example, a broad CAD/CAM survey course should be required for students seeking degrees in all applicable engineering disciplines. The objective of such a course would be to demonstrate that CAD/CAM technology tends to eliminate isolated functions within a product manufacturing organization and that each of the contributors in the organization adds a special level of expertise to a continuum of information. This infusion of expertise builds progressively from the product concept stage (which may be a solid model image developed and stored within the computer) to the production shop floor where every element of data necessary to produce the designer's concept is available to each specific work station via hard copy printer or CRT terminal.[10]

In addition, as vocational modernization increases the integration of our career curricula, student learning will cross current disciplines. A Mechanical Technology student, for example, may design a product using the CAD system, manufacture a prototype using CAM, analyze production costs using a cost accounting software package, write a product manual using a word processing system, and prepare a product advertisement using a graphics software package.

Part III

UPDATING BUSINESS TECHNOLOGY

Impact of Technology on Business and Implications for NIACC

At the Iowa Business Education Association in October, 1984, Gail Modlin, in her paper entitled "Preparing Your Students for the Office," made the following observations:

"At the turn of the century, farmers constituted more than one-third of the total labor force--now they make up about three percent.

America has also worked itself out of the manufacturing business and into the thinking business, and we know that:

- Seventy-five percent of today's information did not exist 20 years ago.

- Eighty percent of today's information will be replaced by 1991.

- The amount of available information doubles every 20 years.

For the first time in our history, over 60 percent of the labor force is employed in information processing positions. Among them are programmers, teachers, secretaries, accountants, stock brokers, lawyers, technicians, newspaper reporters, librarians, engineers, etc."[1]

With technology changing so rapidly, the office is also constantly changing as business requires the analysis and interpretation of more and more information. To continue to be productive as information demands become greater, people who work in offices will have to understand the new technologies.

In the Business Education World, Spring, 1984, Dr. Rosemary Fruehling, Minnesota State Department of Education, wrote: "Imagine being able to transmit memos electronically in a matter of minutes. A manager, for example, will be able to send 25 memos to 25 branch offices instantly. Or, if she needs a particular report--once it has been put into the computer--she merely taps into the electronic filing system and immediately accesses it.

"It is this instantaneous accessibility that is going to change jobs and, more importantly, teaching methods. This fact does not mean that we will no longer teach the basics. Rather, in addition to the basics, we are going to have to help students to understand and to harness the new technologies them to carry out office tasks efficiently.

"When we talk about the electronic office, we must imagine a network in which not only words but also numerical and graphic data can be processed and distributed throughout an entire organization. In all but a few organizations, the fully integrated electronic system remains the office of the future."[2]

Many Area II businesses routinely use information technologies in their offices. Major local users of word processing systems include many law offices, Banker's Life and Iowa Kemper Insurance Companies, Mercy Hospital, and NIACC. (This proposal was generated at several word processing stations, electronically transferred to a common computer file where it was merged and sequenced, analyzed by Writer's Workbench, edited, and printed on the College's new laser printer.)

These local users of technology hire NIACC graduates. This job market, of course, means that NIACC must provide an office-style environment so secretarial/clerical students can develop the knowledge and skills that are necessary for them to be employable in today's electronic offices.

Approximately 20 years ago, Dr. John Kemeny of Dartmouth College said, "Knowing how to use a computer will be as important as reading and writing." At that time, most people did not believe such a statement would ever be true. Few people had access to a computer. Many had never seen a computer. To some, the computer was a scientific curiosity used by scientists and mathematicians.

Today, the validity of Dr. Kemeny's prediction is apparent. The number of computer systems has increased dramatically since 1965. Microcomputers or personal computers have made computing available to almost everyone. Computer applications have also increased. Businesses and individual households now have computers that are used for a wide range of activities. Because of the widespread use and availability of computer systems, it is now apparent that knowledge of computers and their applications is "as important as reading and writing."[3]

Local data processing applications are evolving from a stage requiring special expertise to a stage where they are common management tools. Accountants, bankers, insurance managers, and other business managers routinely use data-base management systems, electronic filing, electronic spread sheets, and related computer software on mainframe and microcomputers. Contemporary computer-based technology is changing the way North Iowans do business.

Automated data handling systems are common to many local retailers and wholesalers. Now almost every cash register does all the computation in deciding how much change to give the customer. At McDonalds, for example, a cashier does not punch any numbers; instead, the cashier enters two Big Macs, fries, and a coke; and the machine automatically tallies the price of the items and the total bill, including the tax. Then the operator enters only the denomination of the bill which the customer pays, and the cash register figures the change and triggers an updating of the cash receipts tally by items served.[4]

Businesses today have a pressing need for people who have the skills necessary to work with computers and to use the information this contemporary technology can provide.

People from numerous market segments--including entrepreneurs of small businesses--have accepted and are becoming familiar with microcomputers. It is not enough for students to learn how to operate this equipment. They must also develop an understanding of issues facing business people who must make decisions about how such equipment can contribute to profitable operations.

Microcomputers provide businesses with information about daily routine transactions and with complex reports giving owners decision making information. This information helps improve customer service, reduce inventories, tighten cost control, and increase production.[3]

The electronic revolution poses an immediate challenge to today's community college. Because computers impact almost all areas of business and industry, students enrolled in community college programs need to become involved with specific computer applications, especially in their chosen career fields.[6] At North Iowa Area Community College we see this challenge as an opportunity to serve the diverse interests of students and, in a broader scope, the entire community.

NIACC finds itself in a position not unlike other educational institutions trying to find the most efficient way to use limited funds to provide their markets with the best possible learning environments. Business and industry want individuals who have computer skills and who can become productive in the shortest time possible. NIACC has taken steps to create courses that can provide students with knowledge and skills necessary to succeed in the business world. However, change continues at a more rapid pace than ever before; and we find ourselves in a situation where, if we do not make a sincere effort to keep pace, our students will not be able to compete in the marketplace. We recognize that, if we are going to keep pace, we must continue to upgrade our educational hardware and software.

In 1983, NIACC staff developed a position paper on computers and computing and their implications for NIACC. The following are excerpts from that paper.

1. Continue to integrate the use of computer technology to the Business curricula.

2. Create computer access which is convenient and user friendly.

3. Determine the feasibility of implementing a computer literacy requirement through discussions with the division heads and others.

4. Continue to use the College's advance position in computer education in our public information and marketing efforts.[5]

Our Proposal and Plans for Updating Business Technology

Our 1984-85 proposal for updating business technology addresses both office technology and microcomputer technology. Each of these areas will be considered separately in the following sections.

Present Status of Office Technology at NIACC

At the present time, the office practice classes for secretarial/clerical students are held in McAllister Hall (MH), Room 214. There are no computers in that room; however, there are ten terminals that students may use in MH, Room 210. These computers are used by many other students, so the secretarial/clerical students have access to these machines only one or two hours a week.

This level of access allows them to become "acquainted" with a computer but does not allow the time needed to build adequate production skills.

With the machine transcribers (dictaphones) in MH 214 and the terminals in MH 210, the students cannot transcribe on a computer as they will probably have to do in many offices where they will be employed. They also must do their assignments using typewriters rather than computers; consequently, they are not developing understanding of the various technologies of the modern office (word processing, information processing, electronic mail, records management). Nor are they learning the relationship between the technologies and the job functions of secretarial/clerical workers.

Office Technology Proposal for 1984-85

Equipment Selection. The first phase of a three- to five-year plan to update the secretarial/clerical programs should include the purchase of furniture, hardware, and software for MH, Room 214.

The following criteria were considered:

1. The need to have stand-alone capability as well as being on-line with a main frame.

2. The need for software that has been proven to be a sound instructional tool that can provide multiple applications.

3. The need for an environment that will provide the student with the opportunity to become familiar with a variety of applications, such as word processing, electronic mail, records management, and electronic filing.

4. The need to have software and hardware that can be upgraded and that will not become totally obsolete in a short period of time.

5. The need for hardware and software that provide the student directions necessary to complete tasks, for example, manuals, control keys, and other aids to assist the student and instructor.

6. The need for a variety of printers that can produce different formats.

7. The need to create a modern office-like environment.

Based on these criteria, we recommend the following equipment:

	Equipment	Unit Cost	Total Cost
28	DECmate III computers (includes video display monitor, unattached keyboard, CP/MTM Board, and Connector Pods)	$2,000.00	$56,000.00
28	Secretarial desks and chairs	650.00	18,200.00
2	Letter-quality printers	1,500.00	3,000.00
2	Laser printers	3,000.00	6,000.00
3	Dot matrix printers	1,000.00	3,000.00
	Software		2,500.00
			$88,700.00

Curricular application. The modern office environment will provide the Business Division with "state of the art" hardware which will provide our programs with unique opportunities to deliver our office curricula. The curricula for these programs are integrated to some degree, so a core of courses is applicable to all of the programs. The objectives of the core courses would be delivered in a more efficient manner in the automated office environment. Skill development is vital in these programs because of the brief length of some programs and the need to apply these skills directly to a job upon graduation. The success of these programs lies in the success a student has in finding and succeeding on a job. The best advertising we have is by students who complete our programs and tell others. It is our feeling this automated office environment will enhance our efforts in both quality level and quantity level in our Secretarial and Clerical programs.

The equipment purchases would do the following things for our Secretarial and Clerical programs.

1. Provide an automated office environment.
2. Provide more efficient training on word processing equipment.
3. Develop more efficient and productive skills.
4. Teach basic language skills (grammar, punctuation, spelling, capitalization, word usage) from an applied point of view.

5. Stress the following work factors

   a. Management of time
   b. Professional attitude and self-confidence
   c. Ability to follow written directions
   d. Determine priority tasks
   e. Ability to work without constant supervision
   f. Acceptance of criticism

Students to be served. It is our belief that an automated office environment not only will improve our curriculum but also will increase the number of students to be served. This room would be available to students from other areas as well. For example, the Community Services Division could offer night classes to other segments of our market. This room would also provide access to other students who have a need to use computer terminals. Students involved with Writer's Workbench, students in Communication Skills who run CIGI programs, and students in Advanced Basic Programming could all benefit from this room. Tables 1 and 2 illustrate the programs and students that will be served in Room 214.

Table 1

Programs and Students Served in MH 214

Program	Current Enrollment	Increase 1985-1986*
Acc[illegible]g Clerk	10	2
Clerical Receptionist	2	1
Nine-Month Clerical	14	2
Executive Secretary	7	2
Nine-Month Secretarial	15	3
Medical Assistant	17	3
Optometric Assistant	18	2
One- and Two-Year Medical Secretaries	14	2
One- and Two-Yer Legal Secretaries	9	2
TOTAL	106	Increase - 19

*Increase is based on the establishment of the automated office environment and our marketing efforts to increase enrollment.

Table 2

Others Who Will Be Served in MH 214

Students	Applications	Time
Adults	Word processing skills	Nights
Writer's Workbench	Develop writing skills	Open labs (day and night)
Communications Skills	CISI programs	Open labs (day and night)
Advanced Basic	Write programs	Open labs (day and night)
Medical Assistants	Outside assignments (8 hours per week)	Open lab
Nine-Month Secretaries	Outside assignments (10 hours per week)	Open lab
Nine-Month Clericals	Outside assignments (10 hours per week)	Open lab

The numbers of students that will be served is somewhat hard to measure because of the variety of people using this environment outside the secretarial and clerical area. However, we want this facility open from 7:30 a.m. to 10:00 p.m. during the week. Our goal is to use the equipment productively and effectively by making it available to students as much as possible.

Location and layout. The location of the proposed automated office environment would be in Room 214 of McAllister Hall. This room is currently being used in a similar capacity, so there is no need to do any remodeling work to modify the room. The layout for the room is shown in Figure 1, which details the proposed configuration of the clusters of work stations. The rationale and considerations for this configuration follow:

1. Each work station will be large enough to be equipped with a DECmate III, typewriter, and dictation equipment. This arrangement would provide an exact simulation of many offices.

2. Location and layout provide an alternative eye-catching facility for students and visitors.

3. This arrangement is the most appropriate for delivering instruction. The instructor still has the opportunity to deliver group instruction.

4. The instructor will have visual contact with all clusters.

5. The clusters are away from the windows to reduce reflection on the screens. Lighting will be monitored to see that it is at an appropriate level.

6. The room will have to be wired for ports so the equipment will be on line with the mainframe computer.

7. The room is as aesthetically sound as possible. The recent addition of new carpeting and new furniture will contribute to the aesthetics of the room.

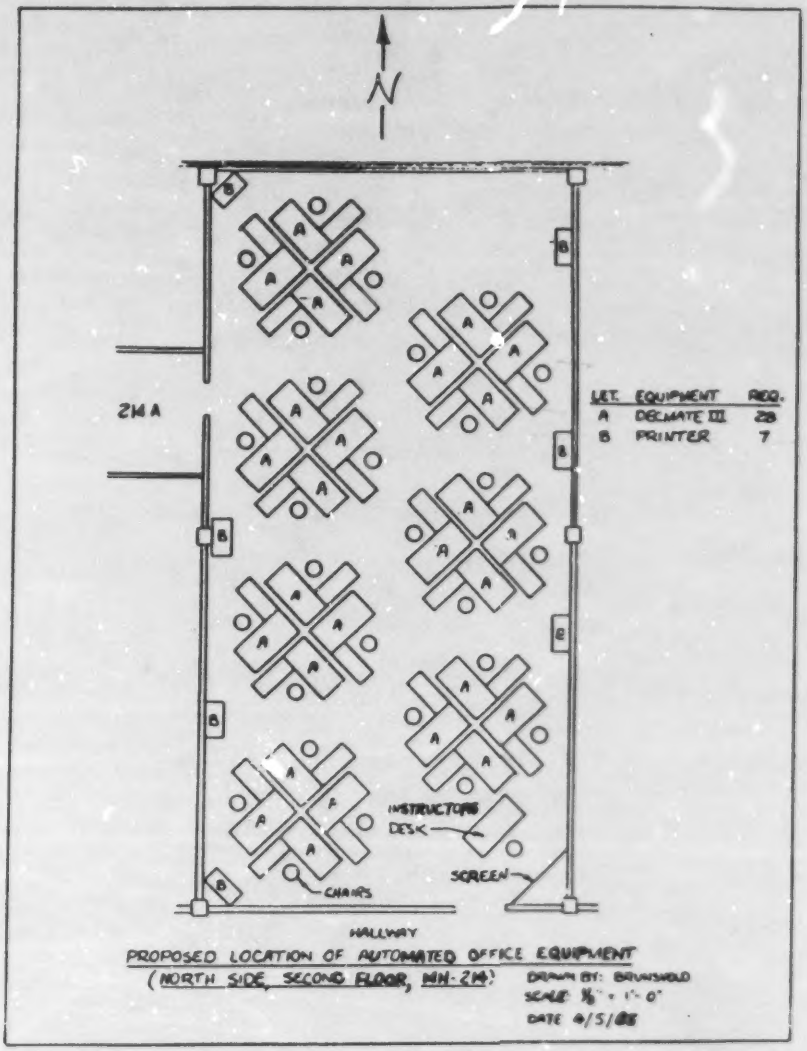

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Figure 1

Proposed Location of Automated Office Equipment

Present Status of Microcomputer Technology at NIACC

To serve students enrolled in Introduction to Data Processing, we currently have 19 Apple II+ microcomputers in the NIACC Learning Center and 10 Franklin ACE 1000 microcomputers in McAllister Hall. We have been averaging 275 students in this course every semester. These computers are also shared with Community Services and with the Pascal programming class. In the spring semester, the Microcomputer Accounting class places an additional load on this equipment.

We have a number of problems with the present configuration:

1. We need computers with more internal memory than our microcomputers have to enable us to teach more sophisticated software applications such as electronic spread sheets, data base management, and possibly word processing.

2. We need to equip a lab large enough to teach software applications to an entire class.

3. We need to provide an opportunity for the Community Services Division to update its computer technology.

Meeting these needs will enable NIACC to be recognized as a leader in providing instruction in contemporary technology. Creating a microcomputer laboratory for business applications will enable NIACC to provide quality instruction on state-of-the-art equipment and software.

It is our plan to provide students more opportunity to use more computer software by developing a microcomputer lab where instructors can deliver instruction to students who are taking Introduction to Data Processing. The Business and Community Services Divisions are both involved in this proposal because we both see a need to provide this software instruction for people in the community. Software instruction should not be limited to credit students but should be offered to anyone who needs, wants, and can benefit from this instruction. We believe this instruction is part of our responsibility to the people of Area II.

Microcomputer Technology Proposal for 1984-85

Equipment selection. Reflection on these factors led to these criteria for selecting microcomputer equipment and software:

1. The equipment and software should be widely used in local businesses.

2. The equipment should have the capability of being upgraded.

3. The equipment should have the capability of being networked with other microcomputers and interfaced with larger systems.

4. The equipment should have high resale potential.

5. The equipment should carry a widely recognized company name that would contribute to NIACC's prestige and leadership.

6. The equipment company should have a stability which insures continuing service and software support.

The quality of educational computing in a school is going to depend on the quality of the software being used. The importance of such software is becoming very evident in the delivery of instruction in our computer courses. We are being told by advisory committee members from our career programs, as well as four-year institutions, that we must provide students with exposure and training in software applications. Word processing, electronic spread sheets, and data base management applications are becoming commonplace when using microcomputers.

On the basis of these criteria, we have selected IBM microcomputer equipment for this laboratory. Lotus 1, 2, 3, and Symphony were chosen as the software to be purchased for this lab because each includes spread sheet, data base management, and word processing functions in one package.

The equipment included in the laboratory configuration will serve 21 campus students per class. The proposal asks for 30 stations because the Community Services Division feels there is a market in Area II to go into local communities and provide instruction on traveling IBM microcomputers. These nine microcomputers could be utilized on campus when they are not being used in local communities.

Each unit will consist of an IBM PC with an IBM color display, an IBM disk operating system, an IBM graphic printer, and work station furniture. The furniture for the lab would be patterned after a similar lab at the University of Iowa. At UNI, the furniture was built by a University employee to get the most functional laboratory at a reasonable price. We plan to consider a similar procedure.

Cost estimates for the hardware, software, and furniture for the business microcomputer laboratory are as follows:

30 IBM PCs.....	$1,560.60/unit x 30 =	$46,818.00
30 color displays.....	439.00/unit x 30 =	13,170.00
30 graphics printers.....	341.00/unit x 30 =	10,230.00
30 cable connectors.....	45.00/unit x 30 =	1,350.00
30 DOS (Disk Operating Systems)....	65.00/unit x 30 =	1,950.00
30 printer interface boards.....	170.00/unit x 30 =	1,500.00
Software.....	=	5,000.00
Furniture.....	=	6,000.00
Per Unit	$2,620.60 TOTAL	$86,018.00

Curricular applications. The microcomputer has become a vital tool in the delivery of a number of courses at NIACC. Although programming courses were the first to use the microcomputer to assist students in completing the course work, other areas have also used the microcomputer to achieve course objectives. Courses in Mechanical Design, Engineering, math, and Business have all used microcomputer applications.

There are a variety of individual courses as well as total programs that can use microcomputer applications. For example, areas within the Business Division that need to use microcomputer applications include Accounting classes, Marketing and Management classes, as well as Introduction to Business and Salesmanship from the General Business curriculum. Career programs that would benefit would be Accounting Clerk, Retail Merchandising, and Marketing Management (Wholesale). Software applications would cover a variety of skills: inventory control, billing, payroll, sales orders, sales analysis, accounts payable, accounts receivable, general ledger, and cash flow. These skills need to be developed by students to enable them to be successful in the marketplace. This IBM Lab would provide opportunities for our students to use this type of software. The use of this lab will improve the qulity of students that would graduate from our program.

There are also reasons why we are looking at IBM equipment and its applications to our curriculum. NIACC is trying to develop a variety in the types and brands of equipment our students are exposed to and can work with. We currently have Apple and Franklin microcomputers. IBM would give NIACC added variety to broaden its scope for software application. By providing opportunities for students to use different brands of equipment, it increases the students' exposure and upon graduation could possibly benefit in the job market.

The proposed lab would have impact in developing discussions regarding the idea of computer literacy at NIACC. A self-paced, totally individualized approach to computer literacy is a possibility.

The proposed IBM Lab would also provide the opportunity for other disciplines to use this facility. It is an objective of such a facility to be used by students from different areas using the hardware and software from different applications. The greater the number of students that use this facility the greater the level of productivity and efficiency of the lab. More integration between discipline and career programs is a desired result. As NIACC looks at a modernization of career programs for the 90s, it is clear this particular lab could be one delivery tool for that overall objective.

Students to be Served. The microcomputer lab will serve all of the students who are enrolled in the Introduction to Data Processing classes. There are approximately 275 students enrolled in this class every semester. These students would receive software instruction as part of a requirement for the course. Community Services will also provide non-credit offerings in current popular software such as Lotus 1, 2, 3 and Symphony. In 1984-85, Community Services non-credit enrollment was 164 on campus and 395 at traveling locations. Tentative plans are underway to provide short course credit offerings in the area of software instruction. This lab has potential of serving several hundred students every semester.

This lab could also be used by other areas. Other programming classes could use this lab as well as other divisions. There is a great deal of potential limited only by our willingness to become creative in using this facility. The location of this lab will be in Room 210 in McAllister Hall. This room is now being used by students in several career programs who need access to terminals. This room also contains terminals and microcomputers used by the Mechanical Design program which will be relocated to the Mechanical Design Lab.

Location and Layout. The proposed lab would have 21 stations (see Figure 2).

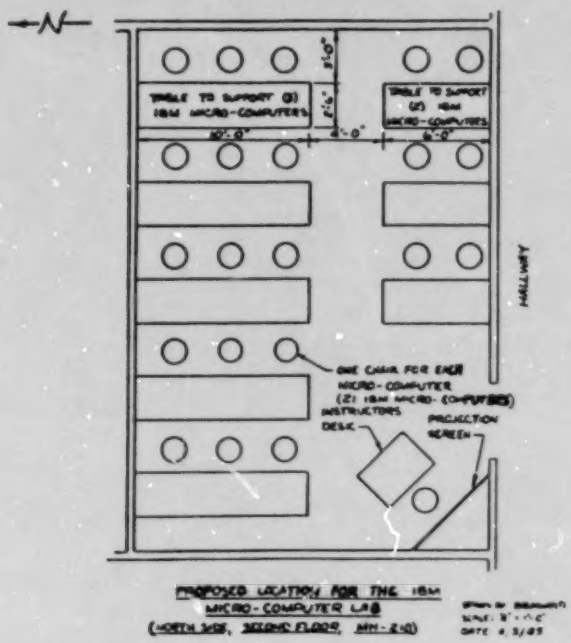

Figure 2

Proposed Location for the IBM Microcomputer Lab

Future Plans in Office and Microcomputer Technology

The role of the computer applications in the educational environment will continue to expand. As an educational institution, NIACC has a responsibility to deliver sound instruction to our market using this contemporary technology. The number of computers and amount of computer access will continue to rise, allowing more people from different disciplines to get involved with this contemporary technology.

Office technology. Integrated office systems have implications for NIACC's future because the employment in this area is expected to increase through the mid-1990s due to the steadily growing need to process information. Because of this need, it is important that a long-term plan be formulated for NIACC's secretarial/clerical programs. The plan for the next phase of the three-to-five year project should include:

1. Updating equipment in the secretarial/clerical classrooms in McAllister Hall. This update could include equipment from different vendors in a different configuration than we have in Room 214 of McAllister Hall to provide our students with as much experience as possible with different applications in this area.

2. Creating an information processing center at NIACC that could process all types of documents for all personnel at NIACC. This center could create, store, and retrieve documents. This center could be used campus-wide and could also be used by other segments of our market.

3. Creating an electronic communication network within the educational system at NIACC. This network, called telecommunications, would enable NIACC to use electronic mail, electronic dictation, and electronic filing.

4. Developing an integrated office system which will link all forms of office equipment such as word processors, graphics displays and printer, copiers, electronic data files, and transcription devices. this integrated system will transmit data from a common storage area within the College.

In summary, reflecting tomorrow's offices, NIACC office technology should encompass data, word, image, and audio processing in an integrated communication network.

Microcomputer technology. Uses of computers in the educational process will increase as technology continues to evolve and improve. It is critical for NIACC to stay abreast of new developments in business and to provide students with the resources necessary to successfully compete in their chosen fields. Therefore, the three-to-five-year project should include:

1. Adding more microcomputer laboratories to accommodate increasing numbers of students and applications.

2. Increasing the variety of equipment manufacturers to provide students experience on several types of equipment.

3. Updating curricula to reflect changes in computer technology.

4. Networking microcomputers with other components of NIACC's information system to integrate word processing and data processing within and across disciplines. For example, business students may analyze CAD/CAM data for cost accounting and marketing purposes.

As in manufacturing technology, contemporary technology will lead to the updating of our business curricula and to better preparation of students for employment in contemporary business.

Part IV

EXPANDING TECHNOLOGY IN THE HUMANITIES

Impact of Technology on the Humanities and Implications for NIACC

The following titles indicate the thrust of over 40 speakers at the National Conference on College Composition and Communication held March 20-23, 1985, in Minneapolis: "Using Computers to Study Error and To Teach Editing," by Hull of the University of Pittsburgh; "A Study of the Effects of Word Processing on the Correctness of Student Writing," by Hult of Texas Technical University; "An Intelligent Tutor for Teaching Revision," by Kaufer of Carnegie-Mellon University.

Only a few years ago, a Humanities teacher interested in computers would not have found help in the national conferences on writing, literature, music, art, and foreign languages. Today, these conferences provide contact with researchers and practitioners in the use of computers in all areas of the Humanities. Whereas a conferee used to spend time locating computer sessions, conferees now spend time choosing among the many exciting offerings.

English. Sessions for English teachers are not discussions of computer-aided instruction in grammar drills; instead, they are challenging presentations of highly sophisticated computer applications of identifying writing protocols and of enabling writers to use that information in developing their thinking and writing skills. In one session, Geoffrey Sirc of the University of Minnesota, described an experience with a student who had just completed writing, revising, and editing a composition on a terminal. The student and instructor then watched the entire writing process on the screen. The computer had recorded and timed every pause, every cursor move, every change. As a result, the student could analyze his own individual writing process and could determine ways in which he could work more effectively.

Foreign Language. Within the Humanities, English and writing have no exclusive claim on the use of the computer. A foreign language student at the University of Illinois sits before a PLATO computer terminal. She presses a key, and this message appears on the screen: "Say 'good day' in German, and then press the 'NEXT' key." The student says aloud, "Guten Tag" and presses "NEXT." The phrase "Guten Tag" appears on the computer screen as the voice of a native speaker pronounces the phrase aloud. Next, the computer gives the student two choices. She may hear a playback of her pronunciation of the phrase followed by that of the native speaker, or she may proceed to another phrase.[1]

Here in Iowa, Grinnell College has a computer language lab for each language department. Using the software DASHER and Digital foreign language keyboards, the instructor is able to create exercises in transformations, scrambled sentences, fill-ins, and translation. The student receives visual feedback that leads her to the recognition of her errors. As a result of instructor involvement in the program, the exercises can correlate with any text and with any course of study.

Graphic Arts. The increasing role of computer graphic arts is evident in the following figures. In 1978, computer-generated graphics accounted for 300,000 presentation slides. In 1984, this number increased to 16,000,000, a growth of 5,300 percent.[2] Computer graphics also play a part in the theater. In an effort that took one and one-half years, the San Francisco Ballet Company developed 17 minutes of computer-generated graphic art, images projected as a part of one of the company's newest dance productions.[3] One only has to turn on the television set to see the effect of computer graphic arts in areas from advertising to program introductions and credits.

At Rutgers, computer art courses move from basic computer languages through graphics, animation, advanced computer graphics, and sound generation, to experiments in computer art. Philip Orenstein of Rutgers advises, "Persons interested in developing computer art courses should start now..." At Western New England College, Engineering Design students employ computer graphics to create devices that improve the mobility of disabled limbs.[4]

Computer graphics technology is revolutionizing the field of graphics design. This technology enables the designer to translate personal and creative ideas into visual information with speed and accuracy. Instead of pens, brushes, X-acto knives, rulers, and paste pots, the designer uses an electrical stylus and tablet to create images of any color and intensity. The artist can modify, store on videotape, or broadcast these images. As a result, many artists and commercial designers are creating graphic images for clients.[5]

More art-related jobs exist today than at any time in the past; the number has increased by 75 percent in the past decade. As individual and corporate teams of designers and artists are asked to respond to the needs of contemporary life, visual arts graduates find a wide range of job opportunities.[6]

NIACC. What is the impact of this important technology on Humanities instruction at NIACC?...significant, but only for a few of our students. We have the software, Writer's Workbench, that heightens our ability to improve writing skills and to develop computer literacy; but we lack the hardware to offer all students an equal opportunity to use and to benefit from the software.

What is the impact of this important technology on NIACC's role as a leader?...significant! Because of the reasoned and effective use of computers in the Humanities Division, the Digital Corporation is considering NIACC as a test site for using Writer's Workbench on the VAX computer and for the uploading/downloading capabilities of the personal computer with the main frame. In addition, both Digital and AT&T Technologies have referred Buena Vista, Carlton, Worcester State College, Milwaukee Area Technical College, and El Paso Community College to NIACC for aid in their efforts to upgrade their English programs.

As a pioneer nationally among universities and community colleges using Writer's Workbench, we must move from the research and development stage that has included only a few students to an instructional level that includes all students. That is, we must if we are to maintain a leadership position that attracts and holds students, that provides a point of pride for area citizens, and that satisfies and motivates taxpayers.

A Proposal and Plan for Using Technology in the Humanities

Present Status. At present, some NIACC students are using the most respected writing analysis program available: Writer's Workbench. Writer's Workbench provides a great deal of information to students about their writings. Providing new perspectives on organization, development, sentence structure, and mechanics, Writer's Workbench creates greater student awareness of and concern for clear communication. Furthermore, the Writer's Workbench information directs the writer to composition entry points at which he may begin making revision and editing decisions that will lead to greater clarity and to an appropriate stylistic level.

But so far, only 100 students have had access to this writing analysis program--only 100 students sharing eight terminals with students in computer programming classes. These 100 students were part of a research project based on the proposition that students using Writer's Workbench would show greater growth in writing skills than would students not using Writer's Workbench.

This research project affirmed that students who use Writer's Workbench can make greater gains in some writing competencies than do students not using Writer's Workbench. Even in this introductory project, while working with experienced teachers newly oriented to Writer's Workbench, students showed observable gains in organization of ideas and in amplification of content.

Furthermore, students using Writer's Workbench made significant gains in writing at appropriate reading levels, in writing more words (associated with fluency), and in writing more content words (associated with specificity). In addition, they strengthened their writing by producing fewer "to be" constructions. These significant gains are evident in the following bar graphs showing the differences in the improved skills of the experimental (Writer's Workbench) group and the control group (see Figure 1).

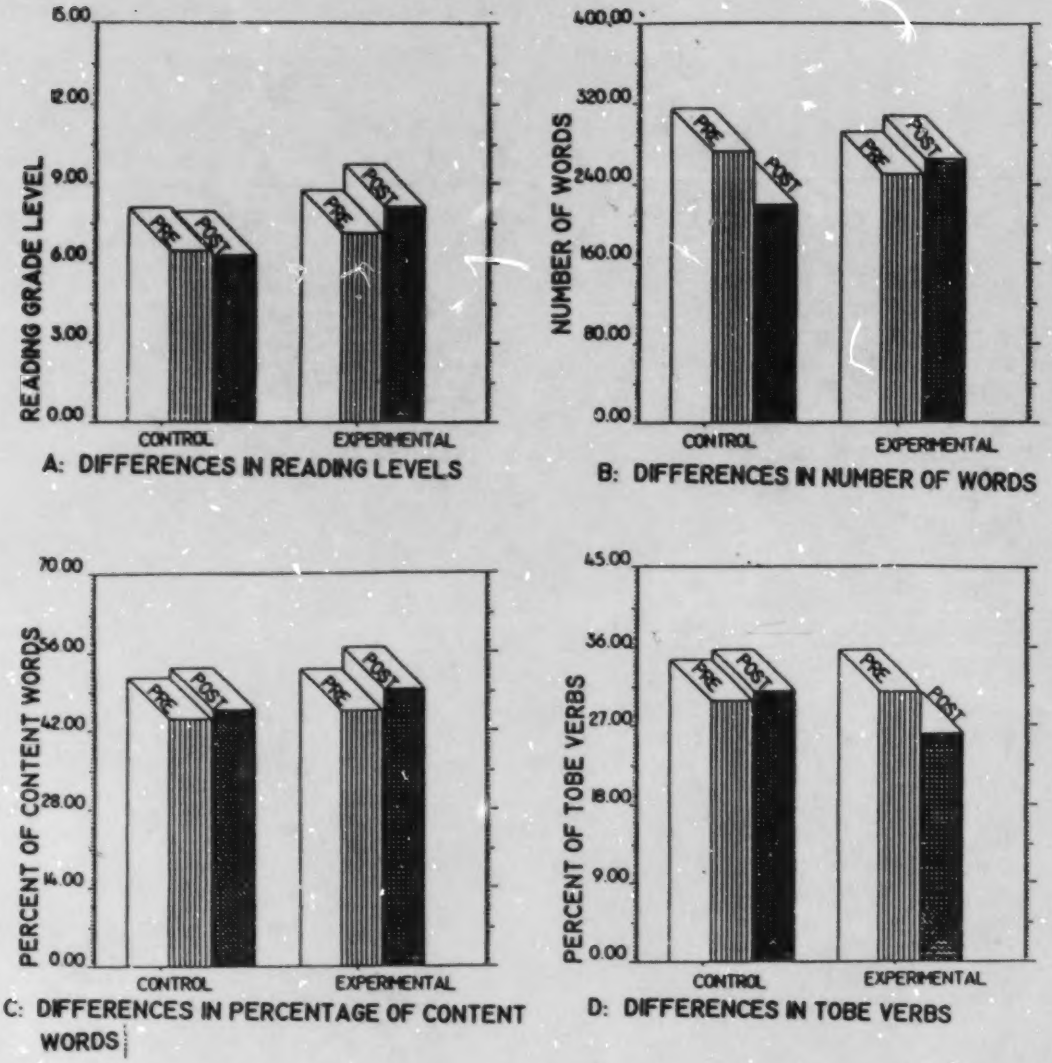

Figure 1

Improvement in Student Writing

While the statistical evidence alone would encourage us to move forward with using computer assistance in teaching writing, our enthusiasm stems from our observations of students in the process of writing. We found that student writers using the computer devoted more time to preparing and to revising and editing their papers. They more readily accepted the concept of writing as a process of development and improvement than did students in the control groups.

Of course, we are already anticipating even more effective ways of using Writer's Workbench. We recognize that our students' use of computers has provided us new ways of looking at the teaching of writing.[7] Additionally, we have observed that this new perspective has carried over into all of our teaching.

Similarly, we have observed that students have a desire to carry their use of the computer and of the writing analysis into their writing for other courses. After completing a semester with Writer's Workbench, students returned to their instructors to ask for account numbers so that they could continue to have access to word processing and to Writer's Workbench for their writing assignments in other areas.

Humanities Proposal for 1984-85. The next logical step is to make the opportunity for using computers to improve writing skills equally available to all students, not just to a select group. To do so with the present type of configuration would be both expensive and inefficient because it would entail the purchase of another VAX dedicated solely to Writer's Workbench and additional terminals. However, an alternative plan, at a considerably lower cost, would serve all NIACC freshman writing students and would make efficient use of present resources.

Equipment selection. The criteria established to select the design of an expanded configuration were as follows.

1. Adequate work stations to provide all 670 freshmen with one and one-half hours computer time each week.

2. Only Writer's Workbench can be on the main frame computer.

3. The computers must have on-line compatability with full use of the keyboard functions.

4. All student writing and revising must be off-line.

5. The word processing system must be user friendly.

6. Each unit must cost less than $2,000.

7. The computers must have the potential for upgrading for foreign language and graphic arts applications.

The plan that meets these criteria includes 18 DECmate III personal computers in clusters of six connected through a mini-exchange to a printer and to Writer's Workbench on the VAX. The following itemized list covers the cost of the project.

Quantity	Item	Cost
18	DECmate III ($1,832.60) (with WPS software)	$32,986.80
3	Miniexchange ($620)	2,400.00
2	LA210 Printer ($1,002)	2,004.00
2	LA50 Printer ($472)	944.00
4	Ports ($700)	2,800.00
	Cables and wiring	3,540.00
6	Tables ($100)	600.00
18	Chairs ($25)	450.00
3	Printer stands ($50)	150.00
18	Security Hold Downs ($25)	540.00
	TOTAL	$46,414.80

While the College will furnish paper and ribbons, students will purchase their own diskettes at a cost of approximately four dollars a diskette. As an added savings, Writer's Workbench will batch and run at night with the output in the Independent Study Lab in Beem Center.

Curricular Applications. As Figure 2 shows, personal computers meet the criterion for having students compose and revise off-line. This advantage frees mainframe resources for other tasks. When the student completes a composition, she may send it via the mini-exchange to the VAX where the document is held in a batch file to be run during night hours when little competition exists for CPU time. The printout from Writer's Workbench will run on an Independent Study Lab printer dedicated to Writer's Workbench printouts. The next morning, associates in the Lab will separate and label the printouts for student pickup. This routine accomplishes an overnight turn-around without slowing the daily operations of the VAX. After planning their revisions, students will call up their documents on the computer screens, make necessary changes, and print clean copies on the printers connected to the computers through the mini-exchanges. The following graphic shows the entire process.

COMPUTER PROCESSING OF STUDENT WRITING

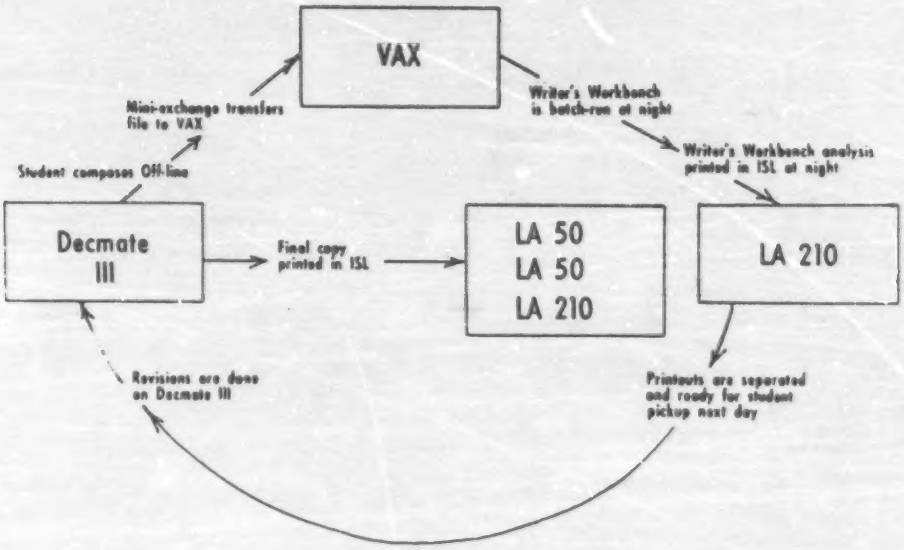
VAX
Mini-exchange transfers file to VAX
Writer's Workbench is batch-run at night
Writer's Workbench analysis printed in ISL at night
Student composes Off-line
Decmate III
Final copy printed in ISL
LA 50
LA 50
LA 210
LA 210
Revisions are done on Decmate III
Printouts are separated and ready for student pickup next day

Figure 2.

Computer Processing of Student Writing

Another process undergirds the student-computer process. This process includes the interaction of the student, the instructor, and Writer's Workbench.[8]

When the instructor assigns a writing, the student creates a partial or complete draft, as directed, and submits the writing to Writer's Workbench for analysis of organization, topic, and development by the ORG, TOPIC, and ABST programs. Using this information and any suggestions from the instructor, the student rearranges, adds, cuts, and strengthens the first draft.

Next, the student submits the revised paper to Writer's Workbench for an analysis of style and reading level. After running the STYLE and FINDBE on the paper, the student again revises, but this time for stylistic rather than structural qualities. Following these revisions, the paper is run through the PROOFR programs for editing analysis, that is, for information about word choice, spelling, and punctuation.

After a final editing, the student presents the paper to the instructor who reads it not only for the elements analyzed by Writer's Workbench but also for the more complex features of rhetoric that require the intelligence and reaction of a human reader. This entire process is reflected in the following figure.

STUDENT — INSTRUCTOR — COMPUTER INTERACTION

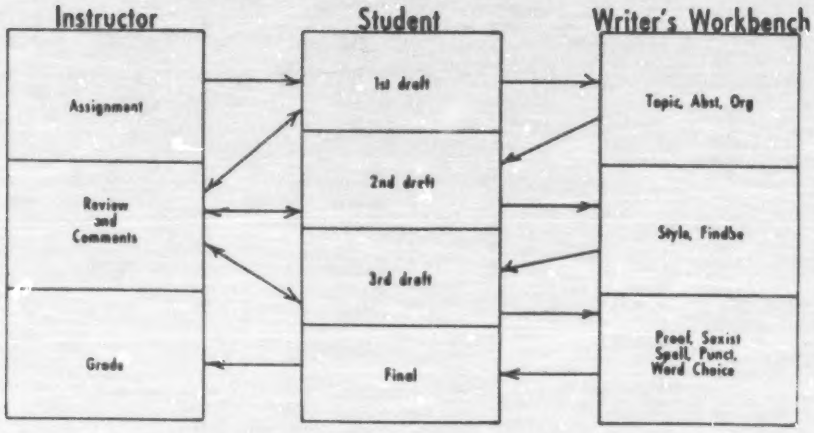

Figure 3

Student-Instructor-Computer Interaction

Students to be served. All students taking Communication Skills I or II (approximately 600 students per semester) and all taking Communications I or II (approximately 170 per semester) will have access to word processing and to Writer's Workbench. Communication Skills students, for the most part, will use Writer's Workbench for compositions and research papers. Communications students will also use it for compositions and research papers but will also submit papers on instructions, processes and procedures, business letters, and reports.

Furthermore, Community Services students, who are frequently persons in business and industry, will have opportunities to use the word processing and writing analysis as computers and computer time permits.

Location and layout. The Independent Study Lab site planned for the personal computers will provide 65 hours of access per week. This open Lab access will allow up to 756 students to use the computers one and one-half hours per week. Because this area has full-time monitors, security and assistance will be available more economically than in any other location. Furthermore, writing instructors' offices are in Beem Center; and most writing classes meet in Beem Center. Therefore, locating the computers in Beem Center will provide easy access for students and instructors (see Figure 4).[9]

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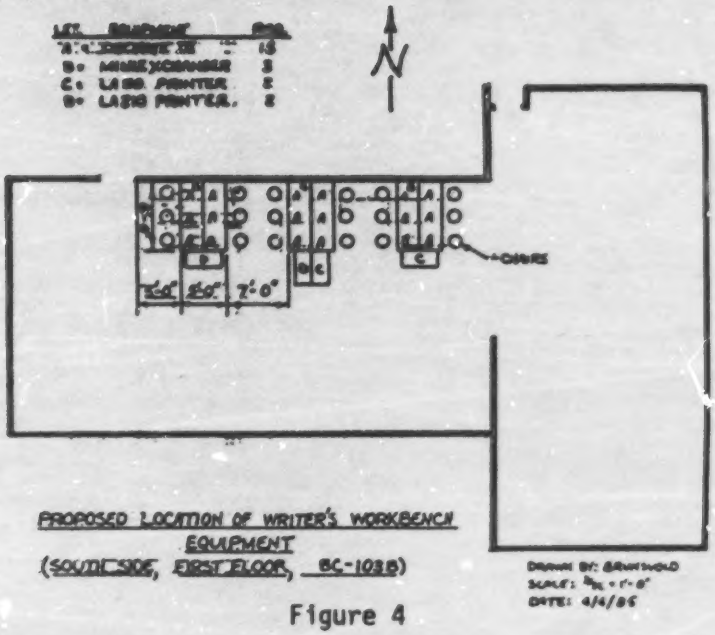

Figure 4

Room Layout

Future Plans for Using Technology in Humanities

Just as all instructors work to use educational resources more effectively each semester, the writing instructors are working toward using computers and Writer's Workbench more and more effectively. Even now, some instructors are developing a plan to use Writer's Workbench as a part of composing as well as a part of revising and editing. These and other instructors plan to use technology as a means for reaching across the curriculum, for reaching across language barriers, and for reaching into new modes of artistic expression.[10]

A natural result of using Writer's Workbench on Humanities writing projects would be the application of Writer's Workbench to writing projects initiated by instructors in all disciplines. Of course, this development would require greater numbers of computers and greater main frame capability to handle the increased demands on computer space.

DECmates, through a simple conversion, can provide foreign language students with foreign language keyboards and printouts. Using this capability, the Humanities Division's plans include software that would assist students in learning and in using languages other than English.

Last year, MacNider Museum hosted a show and demonstrations of graphic art and artists. This year, the Humanities Division is looking to the area of graphic arts as another chance to help students who show interest in commercial and professional applications of graphics. A study has already begun into the potential for the development of such a program.

NIACC's investment in Writer's Workbench is paying high returns for the few students who have access to it. Those high returns over such a short period of time serve as an incentive for further investments with even higher returns over an extended period. Only a few years ago, most educators would have seen little hope for pairing Humanities instructors with high technology. Now in April, 1985, NIACC Humanities instructors seek to integrate high technology as a significant factor in the teaching and learning process.

Part V

SUMMARY AND RECOMMENDATION

Summary

The extensive use of contemporary technology by business, industry, and post-secondary education requires continuous updating of equipment and workers' knowledge and skills. Reflecting a national trend, Area II manufacturers, retailers, financial institutions, and others are expanding their use of contemporary technology. Such updating will continue in the future to enable businesses and industries to remain competitive in their markets; it is essential for their survival.

Similarly, NIACC's contemporary technology strategic planning initiative recognizes that we must continuously update our equipment and our students' skills to remain competitive in our market. We have an obligation to prepare students to live productively in a technological society.

As a next step toward meeting this obligation, we propose equipment investments in the areas of manufacturing technology, business, and humanities. Equipment types, cost estimates, and the estimated number of students to be served in 1985-86 include:

Area and Equipment	Cost Estimate	Students to be served
Manufacturing Technology		
-- An updated 3D Computer Assisted Drafting System	$118,000	180
Business		
-- An updated office education laboratory	88,700	181
-- An updated microcomputer laboratory	86,018	1,109
Humanities		
-- Additional student work stations for Writer's Workbench	46,512	756
	$339,230	2,226

Implementation of this proposal will provide state-of-the-art instruction for credit and noncredit students at NIACC. Every student who enters a credit program in fall 1985 will use computers in their learning. In addition, hundreds of community adults will be able to update or expand their computer-related skills. Consequently, implementation of this proposal will empower NIACC to raise students capabilities for life in an increasingly technological society.

Recommendation

Consistent with the plans included in this proposal, the Contemporary Technology Task Force recommends that the NIACC Board of Directors authorize the expenditure of a sum not to exceed $339,230.00 to enable the College staff to take the next steps in preparing NIACC students for life in an increasingly technological society.

Respectfully submitted,

THE CONTEMPORARY TECHNOLOGY TASK FORCE

Dr. Alfred R. Hecht, Chairman

Manufacturing Group	Business Group	Humanities Group
Jerry Backens	Dan Anderson	Mariestelle Brown
Dennis Brunsvold	Gary Christiansen	Robb Christensen
Charles Perrin	Phil Copenhaver	John Ganio
Bill Rich	Fred Humphrey	Paul Nagy
	Carol Melhus	Carol Watson
	Alice Schamber	Dr. James Zirnhelt

Part VI

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